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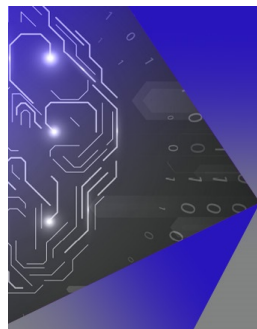
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Indonesian Ethnomathematics for Mathematics Learning in Junior High Schools: A Scoping Review

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Abstract. Ethnomatematics is a learning innovation using culture as a context for studying school mathematics material. Cultural exploration is the first step in finding and analyzing what culture can be used as a context in learning a mathematical concept. The purpose of this scoping review is to identify the results of Indonesian ethno-mathematics exploration in junior high school mathematics material. The method used in this scoping review uses the framework proposed by Arksey and O'Malley's. There are 643 journal articles found through the google scholar database based on predetermined keywords. Furthermore, 36 articles were selected to be used as review material. The article criteria have been used in the last 5 years, from 2016 to 2020. The results of the study show that the results of ethnomatematics exploration in Indonesia for junior high school mathematics material, (1) explored ethnomathematical products in the form of ideas, artifacts and activities; and (2) fields of mathematics related to ethnomathematics, including geometry, algebra and statistics.

INTRODUCTION

Ethnomathematics is a view of cultural diversity that is used in the context of practicing mathematics [1]. Another opinion defines ethnomathematics as the use of various cultures in finding mathematical ideas [2]. Ethnomathematics can also be explained as a concept in education. Mathematics that describes the relationship between mathematics and culture. So that ethnomathematics can be said as a way of constructing a concept, an idea in learning mathematics through the diversity of existing cultures [3].

Every culture has cultural products [4]. In the context of ethnomathematics, it is understood that mathematics as a cultural product has developed as a result of various activities [5]. Another opinion states that a mathematical ideas and activities that are embedded in a culture are known as ethnomathematics [6]. Cultural activities and artifacts as a resource for exploring mathematical ideas embedded in culture [7]. So it can be said that cultural products in mathematics (ethnomathematical products) can be in the form of ideas, artifacts and cultural activities that can be used as contexts in exploring ideas and constructing concepts in learning mathematics.

An idea in context is an idea, procedure, and mathematical action because there are elements of mathematical concepts and culture as a result of thinking [8]. Artifacts can be defined as cultural products created by humans with the aim of solving problems or other needs [9]. Artifacts can be historical archaeological sites, buildings, other

historical objects [10]. Meanwhile, the product of cultural activity in the context of ethnomathematics is mathematical activity. It is defined as an activity in which there is a process of abstraction from real experience in everyday life into mathematics or rather. Includes activities of grouping, counting, measuring, designing buildings or tools, making patterns, counting, determining locations, playing, explaining, measure, and so on [11].`

The activity of exploring culture and making it a context in learning mathematics makes learning meaningful. They can learn how to construct knowledge about a mathematical concept through context [12,13]. The context in this case is culture, so that through ethnomathematics, students can practice critical and creative thinking skills [14]. In addition, through culture, you can instill the character of love for the country by knowing its own culture [15].

Through the ethnomathematical exploration process, educators can develop innovative learning tools, such as multimedia, textbooks, and student worksheets based on ethnomathematics. So that the literature review study aims to analyze the results of ethnomathematical exploration in Indonesia, especially those related to mathematics material for junior high schools.

RESEARCH METHODS

The methodological approach proposed by Arksey and O'Malley forms the basis for this scoping review. The framework of this approach has five stages; (1) identifying research questions, (2) identifying relevant studies, (3) selecting studies, (4) mapping data, and (5) compiling, summarizing and reporting results[16].

Step 1. Identify research questions. The focus of this literature review is the exploration of ethnomathematics in Indonesia for the Junior High School Mathematics curriculum, so the research questions in this study are: (1) what types of research methods are used by researchers?, (2) what ethnomathematical products can be used as content for junior high school mathematics in Indonesia?, and (3) what are the fields and topics math subjects related to ethnomathematics? .

Step 2. Identify the relevant studies. This stage is a process of searching for literature related to ethnomathematical exploration in Indonesia, especially those related to junior high school mathematics. Article title search technique using boolean operators (AND, OR) to combine keywords such as: eksplorasi, ethnomatematika, SMP, exploration, ethnomathematics, Junior High School, and Indonesia. Search literature using the Google Scholar data base with a publication range between 2016 - 2020.

Step 3. Study selection. Based on the search results found 643 articles, then 36 articles were selected to be used as review material. The selection of 36 articles was based on several criteria including language, type of article and research method. The complete list of search terms, inclusion and exclusion criteria is outlined in TABLE 1.

TABLE 1. Key search terms, inclusion and exclusion criteria

Search terms	Criteria	Inclusion	Exclusion
("eksplorasi" and "ethnomatematika" and "SMP") ("exploration" and "ethnomathematics" and "Junior High School" and "Indonesia")	Time Priod	The Last 5 years (2016 - 2020)	Studies outside these dates
	Language	English and Indonesia	Non English and Indonesia Studies
	Type of articel	Journal	proceedings, theses, dissertations
	Material for subject at school level	Junior high school	Outside Junior High School
	Research Method	Qualitative, Eksploratif, ethnografi	Quantitative, mix Methode, Quasi-experiment, research and Development (RnD), Survey

Step 4. Charting the data. After determining the final article based on inclusion and exclusion criteria, then each article is made a summary which is reviewed with various aspects; (1) author, (2) years, (3) research methodology, and (4) results covering ethnomathematical products, relevance to the field and topic of junior high school mathematics material.

Step 5. The final stage of the scoping review framework summarizes and reports the findings. Data from each selected article, then analyzed for extraction and mapping based on the various research methodologies used, the form of ethnomathematics products found, and the topics of mathematics subjects related to ethnomathematics.

RESULT AND DISCUSSIONS

For each article, a summary is made based on various aspects, as explained in step 4. TABLE 2 shows a full description of the aspect that can be deduced from the included research. the included

TABLE 2. Studies included into scoping review

Researcher	Year	Methode	Result	Concept of Mathematics
Ikrimah, *et.al* [17]	2017	Qualitative (exploratory descriptive)	The mathematical elements found include (1) the concept of units that are only understood by the local community, (2) the concept of comparing the area of agricultural land with the number of seeds needed	1. Units 2. Comparison
Sri Wahyu, *et.al* [18]	2018	Qualitative Descriptive	The mathematical elements found are (1) concept of reflection, translation and rotation, (2) similarity concept, (3) the truncated prism and shape of a prism.	1. Tranformation 2. Similarity 3. Building space (prism)
Nuk Tohul Huda [19]	2018	Qualitative Descriptive.	The mathematical elements found in the research are related to geometric concepts, including (1) flat shapes (square, circle, triangle, trapezium, ellipse) and (2) space shapes including spheres, cylinders, blocks, cones.	1. Flat shapes 2. Building space
Lita Khofifah, *et.al* [20]	2018	Qualitative Descriptive.	The mathematical elements found include (1) the concept of reflection and translation (2) 90° and 180° rotation	1. Transformation 2. Geometry
Mariya Herliyani, *et.al* [21]	2018	Qualitative Descriptive.	The mathematical elements found include (1) the concept of number units (2) the concept of flat shapes, circles, triangles (3) The concept of three-dimensional spatial	1. Number operations 2. Build Flat and Build Space
Hartono, *et.al* [22]	2018	Qualitative Descriptive	the results of the research obtained are: (1) form learning context in geometric concepts, namely flat and wake up space, two-dimensional, lines, and angles. (2) The algebraic concept is a number pattern in the form of a constant sequence; (3) fractions, calculating operations especially on natural numbers, sequential numbers through measurement of materials; (4) the tapping of movements and elevation angles in trigonometric material	1. Geometry 2. Algebra
Dwi Yanti Saleh Haji [23]	2019	literature study	Besurek Bengkulu has the concepts of geometric transformation, namely (1) reflection, (2) translation, (3) rotation, and (4) dilation.	Geometry
Hermina Amul, *et.al* [24]	2019	Qualitative Descriptive	The mathematical elements found include: Quadrilateral Limas, Triangular Limas, congruent square-shaped glass, shape, rectangles, rhombuses, triangles, congruent square, trapezoidal and triangular shapes	1. Build flat 2. Flat planes and congruence 3. two-dimentional figure

TABLE 2. Studies included into scoping review

Researcher	Year	Methode	Result	Concept of Mathematics
Maryati Wira pratiwi [25]	2019	Qualitative Descriptive	The ethnomathematics found are (1) the formation of the Saman dance resembling a rectangle and a rhombus, (2) the different costumes of the dancers as a set concept, section set, (3) Saman dancers (universal set).	1. two-dimentional figure and 2. set
Yetti Widiarti, *et.al* [26]	2019	Qualitative Descriptive	ethnomathematics on Bengkulu traditional musical instruments in the form of a circle, namely dol, tassa, rebab, and kulintang	Two-dimentional figure
Hikmawati *et.al* [27]	2019	Qualitative Descriptive	The mathematical elements found include: tumpi-tumpi (equilateral triangle), decrepit (circle), burasa (rectangle), barongko (triangular prism), onde-onde (ball), doko-doko (square pyramid), cake paso (cone), putu coppa (tube)	Build flat and build space
Ni Ketut Agustini, *et.al* [28]	2019	Qualitative Descriptive	The ethnomathematics found include (1) the size of the angle in the traditional house, (2) the foundation (square shape), and the roof (triangle and trapezoid), (3) the traditional house pole (tube)	1. Angle, 2. Build flat and Build space
Sindi Destrianti, *et.al* [29]	2019	Qualitative Descriptive	The ethnomathematics found included (1) Kulintang and Kulintang sticks in the form of a tube, (2) the shape of a gong resembling a tube, (3) the shape of a ball resembling a ball, (4) the number of dancers (odd number patterns), (5) the floor pattern in dance forms a rectangle.	1. Build space 2. Number pattern, Flat shape 3. Angle
Asri Fauzi, *et.al* [30]	2019	Qualitative Descriptive	The results showed that there were mathematical elements in the game dengklaq are concept of the relationship between angles, cube nets, reflection, mathematical logic, and probability.	1. Geometry 2. Opportunity 3. Math logic
Yulia Ervinawati [31]	2019	Qualitative Descriptive	The results show that there are several mathematical concepts contained in Batik Gedog Tuban, such as geometry concepts, geometry transformation, and congruence	Geometry
Dilla Dwi Cahyani, Mega Teguh Budiarto [32]	2020	qualitative research with ethnographic approach.	The results of this study include: (1) The selected ethnomathematical objects include the Kubu-Kubu Inscription, Kaladi Inscription, Harinjing Inscription, Jeru-Jeru Inscription, Linggasuntan Inscription, Roll-Gulung Inscription, Baru Inscription, and Kamalagyan Inscription, and (2) Mathematical concepts found in the inscription include: the concept of flat shapes, transformation geometry, set concept; the concept of unit of measure; and the use of numerals	1. Geometry 2. Statistics 3. Set 4. Number

TABLE 2. Studies included into scoping review

Researcher	Year	Methode	Result	Concept of Mathematics
Rulli Purnama, *et.al* [33]	2020	Qualitative Descriptive	The ethnomathematics found in this study include (1) ethnomathematics in the process of making the Lunggia Woven motifs, namely the concept of transformation (reflection, and scale), measurement (estimation), accuracy (accuracy) and equality, (2) ethnomathematics in the Lunggia Woven Weaving motif. one-dimensional geometry in the form of lines and points, two-dimensional geometry in the form of rectangles, triangles, parallelograms, polygons and rhombuses, and transformation geometry includes reflection, rotation, translation, dilation.	Geometry
Dominikus Kou, Yohanis Ndapa Deda [34]	2020	Qualitative Descriptive	The results showed that in the thelas keta traditional event there were several mathematical concepts, including: the concept of a line, the concept of a flat circle, and the concept of a rhombus, the concept of a rectangular flat shape.	Geometry
Imat Sopiah [35]	2020	Study of literature	The results showed that ethnomathematics in the beliefs of the Baduy community includes the concept of numbers, the concept of sets in the Sundanese Javanese alphabet, and the concept of modulo arithmetic in determining good days to go and start work, and also algebraic concepts for determining auspicious days to get married.	1. Set 2. Number 3. Arithmetic
Natalia Sitanggang [36]	2020	Qualitative Descriptive	In traditional Batak Toba musical instruments, there are mathematical concepts (flat shape and space).	1. Geometry 2. Two-dimentional figure
Yudianto E, *et.al* [37]	2020	Qualitative Descriptive	There is an ethnomathematical concept in the bamboo drying process and determining the appropriate amount of bamboo to make steam namely the proportional relationship. The process of selecting a good bamboo, the concept of building a tube space appears.	1. Ratio 2. Build space
Malalina, *et.al* [38]	2020	Qualitative Descriptive	The results showed: (1) counting the number of human resources in a treasure search group, (2) calculating the wages of each human resource in a team according to their respective duties, (3) calculating the expenditure needed in one search treasure, (4) calculate the number of objects obtained (5) calculate the selling price of the objects obtained	1. Number 2. Set 3. Arithmetic
Jayanti Munthahana, Mega Teguh Budiarto [39]	2020	Qualitative Descriptive	The ethnomathematics found include: (1) Calculating the size of the three-dimensional building on Bale Agung and the prism-shaped pendopo terrace, (2) Reflecting on the reliefs of the dragon temple, (3) Reflecting on the reliefs of the main temple.	Geometry

TABLE 2. Studies included into scoping review

Researcher	Year	Methode	Result	Concept of Mathematics
Lisnani, *et.al* [40]	2020	Literature review	the roof of the museum (isosceles trapezoid), the top and bottom of a rectangular shape, doors and windows (rectangle), window panes (a combination of a rectangle with a semicircle)	Two-dimentional figure
Mega Retno Wulandari, *et.al* [41]	2020	Qualitative Descriptive	The results of the study found ethnomathematical concepts which included: (1) Determining lines, angles, corner points, corner areas, corner legs in East Sumba Tenun Ikat, (2) identifying flat shapes on East Sumba ikat weaving (square, triangle, rhombus, parallelogram). (3) the concept of translation, dilatation, rotation, reflection in East Sumba's Tenun Ikat	Geometry
Dominikus Kou, Yohanis Ndapa Deda [42]	2020	Qualitative Descriptive	The ethnomathematics found in this study include (1). Tools and materials used in thelas keta traditional event; Keta (Lidi), (2) Tools and materials used in the thelas keta traditional event; coins, Kabi (Betel holder), basket, shawl, basin.	1. Two-dimensional figure 2. Line
I Made Ari Purwadi [43]	2020	Qualitative Ethnografi	The ethnomathematics found in this study include (1) doubling the winnings according to the appearance of the dice, (2) Calculation of bet items, (3) Determination of winners and losers by the appearance of the dice.	1. Number Operation 2. Arithmetic 3. Opportunity
Bara Aji Bagus Firdaus, *et.al* [44]	2020	Qualitative Descriptive	The ethnomathematics found in this study are the nursery area, calculation of nursery time with the market, types of prey / season, estimates of the number of seeds needed with land area	1. Two-dimensional figure, 2. Integer operation, 3. Set and ratio
Jhenny Windya Pratiwi, Heni Pujiastuti [45]	2020	Qualitative Descriptive	The results of the study show that the traditional marbles game has ethnomathematics related to mathematical concepts including geometric concepts such as circles, balls, triangles and also the concept of distance.	Geometry
Aida Puji Rahayu, *et.al* [46]	2020	Qualitative Descriptive	The ethnomathematics found in this study are (1) the motif on the Lipa Kaet woven fabric in the form of a rhombus, (2) the Punsan motif in the shape of a hexagon (3) the Ngis Lue motif in the form of an equilateral triangle, (4) the Ritis motif in the form of a rectangle.	Two-dimentional figure
Iran Sairan, *et.al* [47]	2020	Qualitative Descriptive	The ethnomathematics found in this study are (1) traditional foods which include "Kelicuk" in the form of a triangle, "Lemang Paiker" in the form of a tube, and Serabi 44 in the form of a circle; (2) the traditional house of the "Pasemah Air Turuh Empat Lawang" tribe in the form of a Limas	Geometry

TABLE 2. Studies included into scoping review

Researcher	Year	Methode	Result	Concept of Mathematics
Nurjannah, *et.al* [48]	2020	Qualitative Descriptive	The ethnomathematics found in this study include: (1). The "SINGGAHSANA" building in the form of a cube, (2). The pillar on the ladder is in the form of a beam, (3). Tube-shaped visitor seats, (4). the roof of the visitor's seat is pyramidal, (5). The shape of the flower pot is shaped (square, rectangle, pentagon), (6). circular fountain (7). the concept of a set of plants such as frangipani flowers, areca nut trees, pine trees and others, (8). average number of visitors, (9) .seeking profit from entrance fee Number of Visitors	1. Geometry 2. Set 3. Statistics 4. Social arithmetic
Jayanti Munthahana, Mega Teguh Budiarto [49]	2020	Qualitative Descriptive	The ethnomathematics found in this study are cultural buildings in the form of Cubes and Quadrangular Prisms, Numbers and Number Symbols, Geometric Transformations (Translation and Reflection), and Possibilities.	Geometry
Jero Budi Darmayasa, *et.al* [50]	2020	Qualitative Descriptive	The mathematical concepts contained in the majejahitan activity that is reflecting (reflecting) and predicting or predicting patterns	Geometry
Herri Sulaiman Fuad Nasir [51]	2020	Qualitative Descriptive	the ethnomathematics of Panjalin Traditional House is geometri	Geometry
Malalina , *et.al* [52]	2020	literature study	The ethnomathematics found in this study are counting the number of human resources in a treasure quest group; counting the wages for each person in the team based on his or her duties; counting expenses required for a treasure quest; counting the number of objects obtained, and determining the sale price of the objects	1. Number 2. Set 3. Social arithmetic

Furthermore, in this section, the author will categorize the articles reviewed based on the type of research method, the product of ethnomathematics, as well as mathematical concepts/topics.

Type of Research Method

Based on 36 articles that have been reviewed, there are 2 types of research methods used by researchers, namely a qualitative approach and a literature review. There are two types of methods that researchers use in this qualitative approach, namely descriptive methods and ethnographic methods. Researchers who use a qualitative approach, explore ethnomathematical values through the process of collecting data in the field, associated with mathematical concepts contained in relevant books or documents. Observation and interviews are the most frequently used data collection techniques in this type of research [53,54]. While the literature review, the researcher informs the ethnomathematical study through reviewing and linking several secondary reference sources such as articles, books, reports containing cultural information, then linked to mathematical concepts contained in relevant books or documents. This is because the purpose of the literature review reviewis to inform the reader based on the results of other studies related to the current research, linking them with the existing literature.[55].

Based on the classification in TABLE 2, the first step is to identify the paradigm or type of research used by researchers. Classification is described in TABLE 3.

TABLE 3. Type of research method

Research Type	# Article	% Article (n=36)
Qualitative Research		
1. Descriptive	30	83,33%
2. Ethnographic	2	5,56%
Literature Review	4	11,11%
Total	36	100%

Product of Ethnomathematics

There are 3 types of ethnomathematical products or forms, namely ideas, artifacts and cultural activities [6,7]. 36 articles that have been reviewed, there are various ethnomathematical products that have been explored by researchers. There are several articles that produce 1 type of product, but there are also more than that. The ethnomathematical product classification is described in FIGURE 1
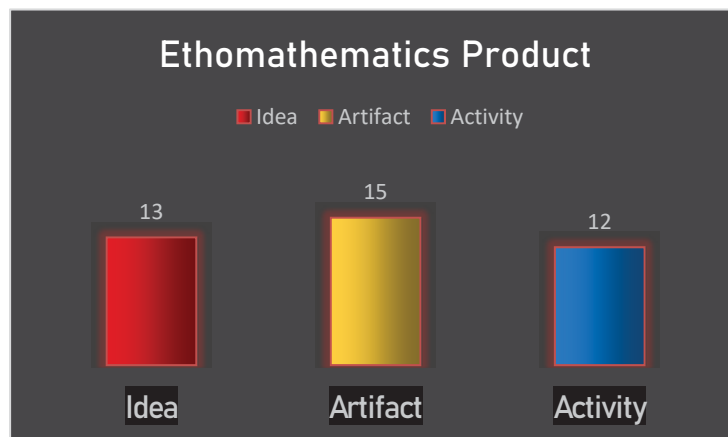

FIGURE 1. Ethnomathematical product classification

Mathematical Concept / Topic

The mathematical concepts contained in ethnomathematical products are concepts taught in mathematics learning for junior high schools in Indonesia. The concept is part of three fields in mathematics, such as Algebra, Statistics, and Geometry. Geometry is the most widely discovered field compared to Algebra and Statistics. This is related to ethnomathematical products in the form of Artifacts that are most explored by researchers (FIGURE 1). The articles that examine artifacts are all related to the field of geometry, although there are artifacts related to other fields. Mathematical concepts in ethnomathematical products are described in TABLE 4

TABLE 4. Mathematical fields and concepts

Field	Consepts	Amount
Geometry	Transformation	11
	Congruent	
	Similarity	
	Building space	
	Line	
	Angels	
	Rotation	
	Translation	
	Reflection	
	Flat Shapes	
	Dilation	
Algebra	Units	5
	Comparison/Ratio	
	Number	
	Opration	
	arithmetic	
Statistics	Set	2
	Opportunity	

Studying geometry is not limited to recognizing object names, but providing context in the form of real objects (such as artifacts) so that students are facilitated in increasing their understanding of geometry and spatial abilities [56]. This can be understood, why artifact products are very closely related to the concept of geometry. So based on figure 1 and table 4, that the number of artifacts is directly proportional to the number of geometric concepts. Furthermore, by paying attention to table 4, the most explored cultural product is geometry. So that the implications of this study can provide information that educators can innovate in learning activities, especially geometry material. These innovations can be in the form of multimedia, realistic learning, textbooks, student worksheets based on culture. This is important, because several studies show that there are still many students who find it difficult to understand the concept of geometry [57,58,59,60,61]. Therefore, educators can use diverse cultural contexts in teaching geometry concepts to their students.

CONCLUSIONS

The conclusions of this literature review are (1) research methods that explore ethnomathematics, namely qualitative and literature review; (2) explored ethnomathematical products in the form of ideas, artifacts and activities; and (3) fields of mathematics related to ethnomathematics, including geometry, algebra and statistics

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